Chapter 1

The Basics of AutoCAD Civil 3D

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Before we get into the "mastering" of AutoCAD Civil 3D, it is important to understand the basics. There are numerous dialogs, ribbons, menus, and icons to pore over. They might seem daunting at first glance, but as you use them, you will gain familiarity with their location and use. In this chapter, you will explore the interface and learn terminology that will be used throughout this book.

In addition, we will introduce the Lines and Curves commands, which offer a plethora of options for drawing lines and curves accurately.

In this chapter, you will learn to:

- Find any Civil 3D object with just a few clicks
- Modify the drawing scale and default object layers
- Modify the display of Civil 3D tooltips
- Navigate the Ribbon's contextual tabs
- Create a curve tangent to the end of a line
- Label lines and curves

The Interface

If you have used Civil 3D 2010 or 2011, the interface for Civil 3D 2012 is basically the same. If you are coming into Civil 3D 2012 from an earlier release, then this part of the chapter is for you. The context-sensitive Ribbon is one of the biggest differences you will encounter. The tools within Civil 3D can now be accessed via the Ribbon. Toolspace and the general look and feel of the Civil 3D interface make this release easy to use. Figure 1.1 shows the Civil 3D palette sets along with the AutoCAD tool palettes and context-sensitive Ribbon displayed in a typical environment.

Toolspace

Toolspace is one of the unique Civil 3D palette sets. Toolspace can have as many as four tabs to manage user data. These tabs are as follows:

- Prospector
- Settings
- Survey
- Toolbox

Using a Microsoft Windows Explorer–like interface within each, these tabs drive a large portion of the user control and data management of Civil 3D.

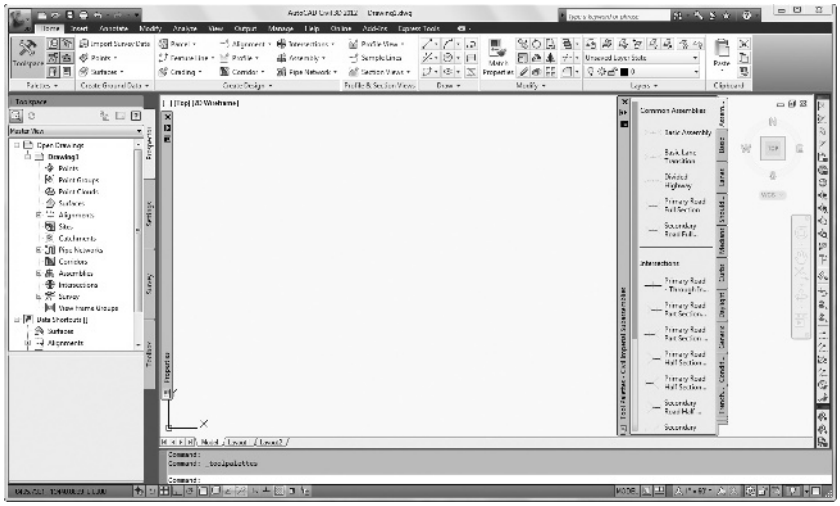


FIGURE 1.1
Civil 3D in a typical environment. Toolspace is docked on the left, and tool palettes float over the drawing window. The Ribbon is at the top of the workspace.

PROSPECTOR

Prospector is the main window into the Civil 3D object model. This palette, or tab, is where you go seeking data; it also shows points, alignments, parcels, corridors, and other objects as one concise, expandable list. In addition, in a project environment this window is where you control access to your project data, create references to shared project data, and observe the check-in and check-out status of a drawing. Finally, you can also use Prospector to create a new drawing from the templates defined in the Drawing Template File Location branch in your AutoCAD Options dialog. Prospector has the following branches:

- Open Drawings
- Projects (only if the Vault client is installed)
- Data Shortcuts
- Drawing Templates

MASTER AND ACTIVE DRAWING VIEWS

If you can't see the Projects or Drawing Templates branch in Figure 1.1, look at the top of the Prospector pane. There is a drop-down menu for operating in Active Drawing View or Master View mode. Selecting Active Drawing View displays only the active drawing and data shortcuts. Master View mode, however, displays the Projects, the Drawing Templates, and the Data Shortcuts branches, as well as the branches of all drawings that are currently open.

In addition to the branches, Prospector has a series of icons across the top that toggle various settings on and off. Some of the Civil 3D icons from previous versions have been removed,

and their functionality has been universally enabled for Civil 3D 2012. Let's take a closer look at those icons:

Item Preview Toggle Turns on and off the display of the Toolspace item preview within Prospector. These previews can be helpful when you're navigating drawings in projects (you can select one to check out) or when you're attempting to locate a parcel on the basis of its visual shape. In general, however, you can turn off this toggle—it's purely a user preference.

Preview Area Display Toggle When Toolspace is undocked, this button moves the preview area from the right of the tree view to beneath the tree view area.

Panorama Display Toggle Turns on and off the display of the Panorama window (which we'll discuss in a bit). To be honest, there doesn't seem to be a point to this button, but it's here nonetheless.

Help This should be obvious, but it's amazing how many people overlook this icon.

HAVE YOU LOOKED IN THE HELP FILE LATELY?

The AutoCAD Civil 3D development team in Manchester, New Hampshire, has worked hard to make the Help files in Civil 3D top-notch and user friendly. The help files should be your first line of support!

Open Drawings

This branch of Prospector contains the drawings currently open in Civil 3D. Each drawing is subdivided into groups by major object type, such as points, point groups, surfaces, and so forth. These object groups then allow you to view all the objects in the collection. Some of these groups are empty until objects are created. You can learn details about an individual object by expanding the tree and selecting an object.

Within each drawing, the breakdown is similar. If a collection isn't empty, a plus sign appears next to it, as in a typical Windows Explorer interface. Selecting any of these top-level collection names displays a list of members in the preview area. Right-clicking the collection name allows you to select various commands that apply to all the members of that collection. For example, right-clicking the Point Groups collection brings up the menu shown in Figure 1.2.

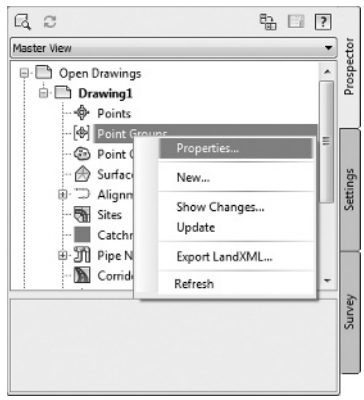


FIGURE 1.2
Context-sensitive menus in Prospector

In addition, right-clicking the individual object in the list view offers many commands unique to Civil 3D: Zoom To Object and Pan To Object are typically included. By using these commands, you can find any parcel, point, cross section, or other Civil 3D object in your drawing almost instantly.

Many longtime users of AutoCAD have resisted right-clicking menus for their daily tasks since AutoCAD 14. In other AutoCAD products this may be possible, but in Civil 3D you'll miss half the commands! This book focuses on the specific options and commands for each object type during discussions of the particular objects.

Projects

The Projects branch of Prospector will only be visible if you are using Vault. This branch allows you to sign in and out of Vault, review what projects are available, manage the projects you sort through for information, check out drawings for editing, and review the status of drawings as well as that of individual project–based objects.

Data Shortcuts

A data shortcut identifies the path to a specific object, in a specific drawing. Many users have found data shortcuts to be ideal in terms of project collaboration for two reasons: flexibility and simplicity.

Drawing Templates

The Drawing Templates branch is added more as a convenience than anything else. You can still create new drawings via the standard File ➢ New option, but by using the Drawing Templates branch, you can do the same thing without leaving Prospector. The Drawing Templates branch searches the file path specified in your AutoCAD Options dialog and displays a list of all the DWT files it finds. You can customize this path to point to a server or other folder, but by default it's a local user-settings path. Right-clicking the name of a template presents you with the options shown in Figure 1.3.

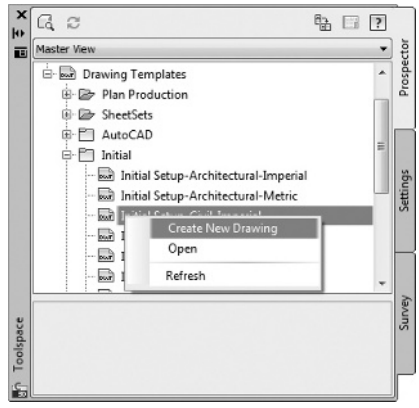


FIGURE 1.3 Creating a new drawing from within the Drawing Templates branch of Prospector. The templates shown here are located in the folder set in your AutoCAD Options dialog.

Civil 3D is built on both AutoCAD and AutoCAD Map, so Civil 3D 2012 comes with a variety of templates. However, most users will want to select one of the top few templates, which start with `_Autodesk Civil 3D` and then have some descriptive text. These templates have been built on the basis of customer feedback to provide Civil 3D with a varying collection of object styles. These templates give you a good starting point for creating a template that meets your needs or the needs of your firm.

Settings

CERT OBJECTIVE

The Settings tab of Toolspace is where you can adjust how Civil 3D objects look and how the Civil 3D commands work. You use this tab to control styles, labels, and command settings for each component of Civil 3D. This book starts by looking at the top level of drawing settings and a few command settings to get you familiar, and then covers the specifics for each object's styles and settings in their respective chapters.

Drawing Settings

Starting at the drawing level, Civil 3D has a number of settings that you must understand before you can use the program efficiently. Civil 3D understands that the end goal of most users is to prepare construction documents on paper. To that end, most labeling and display settings are displayed in inches for imperial users and millimeters for metric users instead of nominal units like many other AutoCAD objects. Because much of this is based on an assumed working scale, let's look at how to change that setting, along with some other drawing options:

1. Open the file `Basic Site.dwg` from this book's companion web page, `www.sybex.com/go/masteringcivil3d2012`.
2. Switch to the Settings tab.
3. Right-click the filename, and select Edit Drawing Settings to display the dialog shown in Figure 1.4.

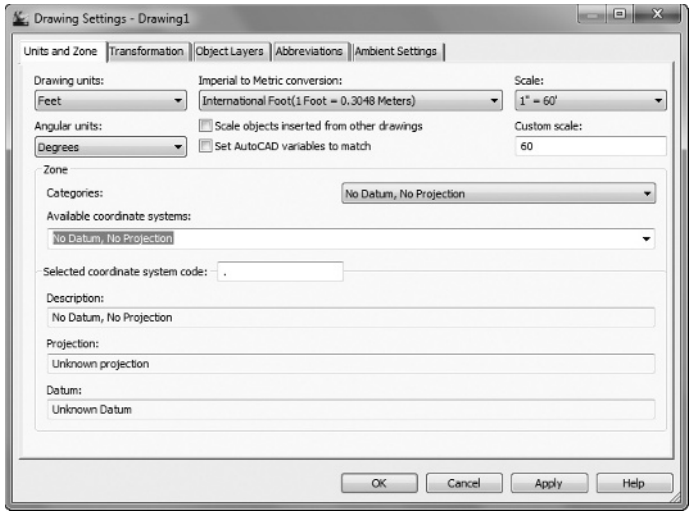


Figure 1.4 The Drawing Settings dialog

Each tab in this dialog controls a different aspect of the drawing. Most of the time, you'll pick up the object layers, abbreviations, and ambient settings from a companywide template. However, the drawing scale and coordinate information change for every job, so you'll visit the Units And Zone and the Transformation tabs frequently.

Units And Zone Tab

The Units And Zone tab lets you specify metric or imperial units for your drawing. You can also specify the conversion factor between systems. In addition, you can control the assumed plotting scale of the drawing. The drawing units typically come from a template, but the options for scaling blocks and setting AutoCAD variables depend on your working environment. Many engineers continue to work in an arbitrary coordinate system using the settings as shown earlier, but using a real coordinate system is easy! For example, setting up a drawing for the Harrisburg, Pennsylvania area, you'd follow this procedure:

1. Select USA, Pennsylvania from the Categories drop-down menu on the Units And Zone tab.
2. Select NAD83 Pennsylvania State Planes, South Zone, US Foot from the Available Coordinate Systems drop-down menu. You could have also typed **PA83-SF** in the Coordinate System Code box.

There are literally hundreds, if not thousands, of available coordinate systems. These are established by international agreement; because Civil 3D is a worldwide product, almost any recognized surveying coordinate system can be found in the options. Once your coordinate system has been established, you can change it on the Transformation tab if desired.

This tab also includes the options Scale Objects Inserted From Other Drawings and Set AutoCAD Variables To Match. In Figure 1.4, both are unchecked to move forward.

The Scaling option has been problematic in the past because many firms work with drawings that have no units assigned and therefore scale incorrectly. But you can experiment with this setting as you'd like. The Set AutoCAD Variables To Match option attempts to set the AutoCAD variables `AUNITS`, `DIMUNITS`, `INSUNITS`, and `MEASUREMENT` to the values placed in this dialog. You can learn about the nature of these variables via the help files. Because of some inconsistencies between coordinate-based systems and the AutoCAD engine, sometimes these variables must be approximated. Again, you won't typically set this flag to True; you should experiment in your own office to see if it can help you.

Transformation Tab

With a base coordinate system selected, you can now do any further refinement you'd like using the Transformation tab (Figure 1.5). The coordinate systems on the Units And Zone tab can be refined to meet local ordinances, tie in with historical data, complete a grid to ground transformation, or account for minor changes in coordinate system methodology. These changes can include the following:

Apply Sea Level Scale Factor Takes into account the mean elevation of the site and the spheroid radius that is currently being applied as a function of the selected zone ellipsoid.

Grid Scale Factor Based on a 1:1 value, a user-defined uniform scale factor, a reference point scaling, or a prismoidal transformation in which every point in the grid is adjusted by a unique amount.

Reference Point Can be used to set a singular point in the drawing field via pick or via point number, local northing and easting, or grid northing and easting values.

Rotation Point Can be used to set the reference point for rotation via the same methods as the reference point.

Specify Grid Rotation Angle Enter an amount or set a line to North by picking an angle or deflection in the drawing. You can use this same method to set the azimuth if desired.

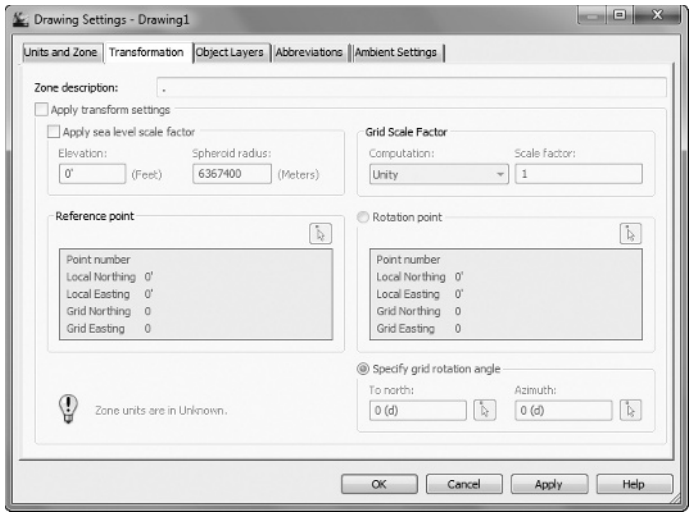


FIGURE 1.5
The Transformation tab

Most engineering firms work on either a defined coordinate system or an arbitrary system, so none of these changes are necessary. Given that, this tab will be your only method of achieving the necessary transformation for certain surveying and geographic information system (GIS)–based and land surveying–based tasks.

Object Layers Tab

Setting object layers to your company standard is a major part of creating the feel you're after when using Civil 3D in your office. The nearly 50 objects described here make up the entirety of the Civil 3D modeling components and the objects you and other users will deal with daily.

Let's see how to change a parameter in the Object Layers tab. First, click the Layer column in the Catchment row, as shown in Figure 1.6. Then in the Layer Selection dialog, select _CATCHMENT and click OK.

ONE OBJECT AT A TIME

Note that this procedure only changes the Catchment object. If you want to change the standard of all the objects, you need to adjust the Catchment Labeling, Catchment Table, Profile, Profile View, Profile View Labeling, and so on. To do this, it's a good idea to right-click in the grid view and select Copy All. You can then paste the contents of this matrix into Microsoft Excel for easy formatting and reviewing.

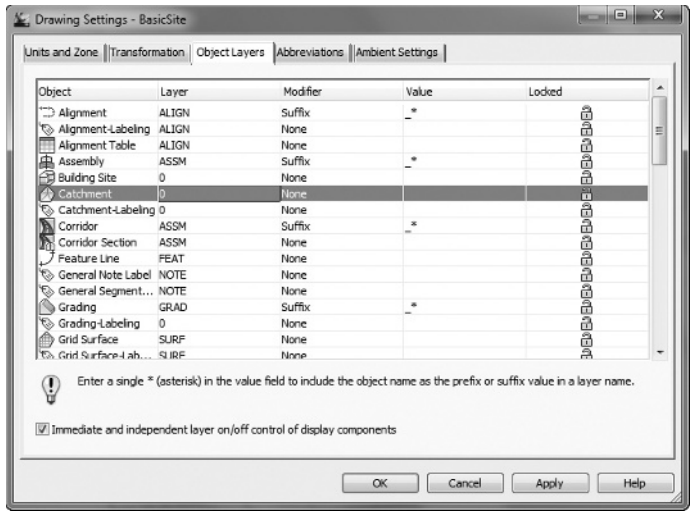


FIGURE 1.6
Changing the Layer setting for the Catchment object

One common question that surrounds the Object Layers tab is the check box at the lower left: Immediate And Independent Layer On/Off Control Of Display Components. What the heck does that mean? Relax—it's not as complicated as it sounds.

Many objects in Civil 3D are built from underlying components. Take an alignment, for example. It's built from tangents, curves, spirals, extension lines, and so on. Each of these components can be assigned its own layer—in other words, the lines could be assigned to the LINES layer, curves to the CURVES layer, and so on. When this check box is selected, the *component's* layer exerts some control. In the example given, if the alignment is assigned to the ALIGN layer and the box is selected, turning off (not freezing) the LINES layer will make the line components of that alignment disappear. Deselect this control, and the LINES layer's status won't have any effect on the visibility of the alignment line components.

Finally, it's important to note that this layer control determines the object's parent layer *at creation*. Civil 3D objects can be moved to other layers at any time. Changing this setting doesn't change any objects already in place in the drawing.

Abbreviations Tab

You could work for years without noticing the Abbreviations tab. The options on this tab allow you to set the abbreviations Civil 3D uses when labeling items as part of its automated routines. The prebuilt settings are based on user feedback, and many of them are the same as the settings from Land Desktop, the last-generation civil engineering product from Autodesk.

Changing an abbreviation is as simple as clicking in the Value field and typing a new one. Notice that the Alignment Geometry Point Entity Data section has a larger set of values and some formulas attached. They are more representative of other label styles, and we'll visit the label editor in Chapter 19, Styles.

Ambient Settings Tab

The Ambient Settings tab can be daunting at first. The term *ambient* means "surround" or "surrounding," and these settings control many of the math, labeling, and display features, as well

as the user interaction surrounding the use of Civil 3D. Being familiar with the way this tab works will help you further down the line, because almost every other setting dialog in the program works like the one shown in Figure 1.7.

You can approach this tab in the following ways:

Top to Bottom Expand one branch, handle the settings in that branch, and then close it and move to the next.

Print and Conquer Expand all the branches using the Expand All Categories button found at the lower right.

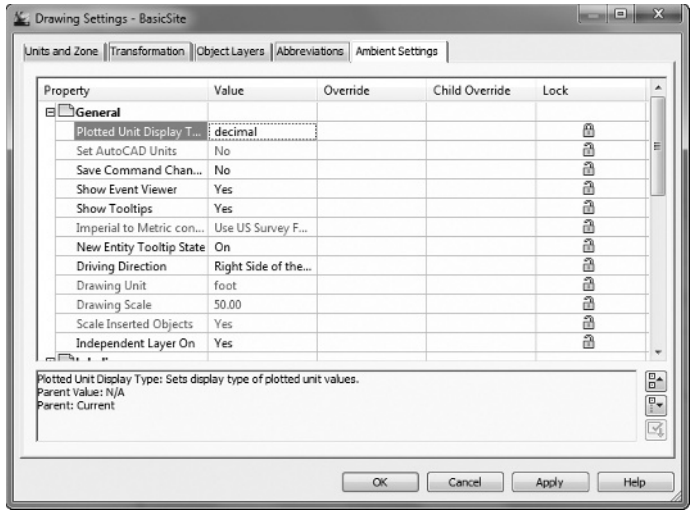


FIGURE 1.7
The Ambient Settings tab with the General branch expanded

DRAWING PRECISION VS. LABEL PRECISION

You can create label styles (discussed in Chapter 19, "Styles") to annotate objects using precision, units, or specifications other than those set in the Ambient or Command Settings dialog. Establish settings to reflect how you'd like to input and track your data, not necessarily how you'd like to label your data.

The Ambient Settings for Direction offer the following choices:

- Unit: Degree, Radian, and Grad
- Precision: 0 through 8 decimal places
- Rounding: Round Normal, Round Up, and Truncate

- Format: Decimal, two types of DDMMSS, and Decimal DMS
- Direction: Short Name (spaced or unspaced) and Long Name (spaced or unspaced)
- Capitalization
- Sign
- Measurement Type: Bearings, North Azimuth, and South Azimuth
- Bearing Quadrant

From this list, it becomes clear where these settings apply to the tools discussed in this chapter. When you're using the Bearing Distance transparent command, for example, these settings control how you input your quadrant, your bearing, and the number of decimal places in your distance.

Explore the other categories, such as Angle, Lat Long, and Coordinate, and customize the settings to fit how you work.

At the bottom of the Ambient Settings tab is a Transparent Commands category. These settings control how (or if) you're prompted for the following information:

Prompt For 3D Points Controls whether you're asked to provide a *z* elevation after *x* and *y* have been located.

Prompt For Y Before X For transparent commands that require *x* and *y* values, this setting controls whether you're prompted for the *y*-coordinate before the *x*-coordinate. Most users prefer this value set to False so they're prompted for an *x*-coordinate and then a *y*-coordinate.

Prompt For Easting Then Northing For transparent commands that require Northing and Easting values, this setting controls whether you're prompted for the Easting first and the Northing second. Most users prefer this value set to False, so they're prompted for Northing first and then Easting.

Prompt For Longitude Then Latitude For transparent commands that require longitude and latitude values, this setting controls whether you're prompted for Longitude first and Latitude second. Most users prefer this set to False, so they're prompted for Latitude and then Longitude.

After you have expanded the branches, right-click in the middle of the displayed options and select Copy To Clipboard. Then paste the settings to Excel for review, as you did with the Object Layers tab.

Sharing the Workload

The print and conquer approach makes it easy to distribute multiple copies to surveyors, land planners, engineers, and so on and let them fill in the changes. Then, creating a template for each group is a matter of making their changes. If you're asking end users who aren't familiar with the product to make these changes, it's easy to miss one. Working line by line is fairly foolproof.

After you decide how to approach these settings, get to work. The settings are either drop-down menus or text boxes (in the case of numeric entries). Many of them are self-explanatory and common to land-development design. Let's look at these settings in more detail (see Figure 1.7).

Plotted Unit Display Type Remember, Civil 3D knows you want to plot at the end of the day. In this case, it's asking you how you would like your plotted units measured. For example, would you like that bit of text to be 0.25" tall or ¼" high? Most engineers are comfortable with the Leroy method of text heights (L80, L100, L140, and so on), so the decimal option is the default.

Set AutoCAD Units This displays whether or not Civil 3D should attempt to match AutoCAD drawing units, as specified on the Units And Zone tab.

Save Command Changes To Settings This setting is incredibly powerful but a secret to almost everyone. By setting it to Yes, your changes to commands will be remembered from use to use. This means if you make changes to a command during use, the next time you call that Civil 3D command, you won't have to make the same changes. It's frustrating to do work over because you forgot to change one out of the five things that needed changing, so this setting is invaluable.

Show Event Viewer Event Viewer is Civil 3D's main feedback mechanism, especially when things go wrong. It can get annoying, however, and it takes up valuable screen real estate (especially if you're stuck with one monitor!), so many people turn Show Event Viewer off. We recommend leaving it on and pushing it to the side if needed.

Show Tooltips One of the cool features that people remark on when they first use Civil 3D is the small pop-up that displays relevant design information when the cursor is paused on the screen. This includes things such as Station-Offset information, Surface Elevation, Section information, and so on. Once a drawing contains numerous bits of information, this display can be overwhelming; therefore, Civil 3D offers the option to turn off these tooltips universally with this setting. A better approach is to control the tooltips at the object type by editing the individual feature settings. You can also control the tooltips by pulling up the properties for any individual object and looking at the Information tab.

Imperial To Metric Conversion This displays the conversion method specified on the Units And Zone tab. The two options currently available are US Survey Foot and International Foot.

New Entity Tooltip State You can also control tooltips on an individual object level. For instance, you might want tooltip feedback on your proposed surface but not on the existing surface. This setting controls whether the tooltip is turned on at the object level for new Civil 3D objects.

Driving Direction This specifies the side of the road that forward-moving vehicles use for travel. This setting is important in terms of curb returns and intersection design.

Drawing Unit, Drawing Scale, and Scale Inserted Objects These settings were specified on the Units And Zone tab but are displayed here for reference and so that you can lock them if desired.

Independent Layer On This is the same control that was set on the Object Layers tab.

The settings that are applied here can also be applied at the object levels. For example, you may typically want elevation to be shown to two decimal places, but when looking at surface elevations, you might want just one. The Override and Child Override columns give you feedback about these types of changes. See Figure 1.8.

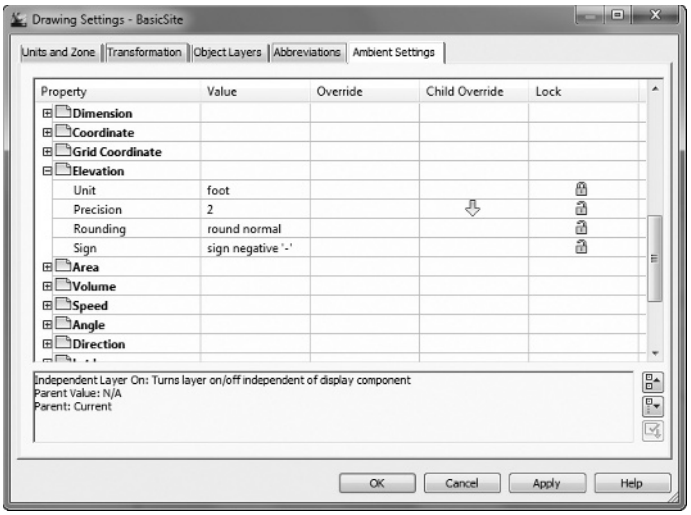


FIGURE 1.8
The Child Override indicator in the Elevation values

The Override column shows whether the current setting is overriding something higher up. Because you're at the Drawing Settings level, these are clear. However, the Child Override column displays a down arrow, indicating that one of the objects in the drawing has overridden this setting. After a little investigation through the objects, you'll find the override is in the Edit Feature Settings of the Profile view, as shown in Figure 1.9.

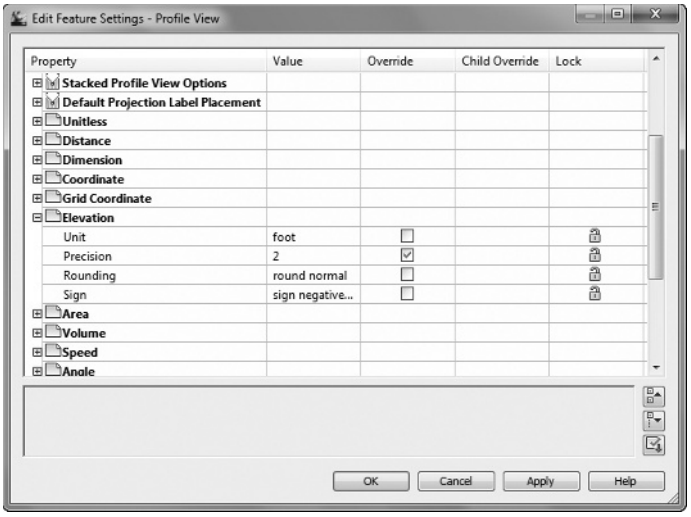


FIGURE 1.9
The Profile Elevation Settings and the Override indicator

Notice that in this dialog, the box is checked in the Override column. This indicates that you're overriding the settings mentioned earlier, and it's a good alert that things have changed from the general Drawing Settings to this Object Level setting.

But what if you don't want to allow those changes? Each Settings dialog includes one more column: Lock. At any level, you can lock a setting, graying it out for lower levels. This can be handy for keeping users from changing settings at the lower level that perhaps should be changed at a drawing level, such as sign or rounding methods.

Object Settings

CERT OBJECTIVE

If you click the Expand button next to the drawing name, you see the full array of objects that Civil 3D uses to build its design model. Each of these has special features unique to the object being described, but there are some common features as well. Additionally, the General collection contains settings and styles that are applied to various objects across the entire product.

The General collection serves as the catchall for styles that apply to multiple objects and for settings that apply to *no* objects. For instance, the Civil 3D General Note object doesn't really belong with the Surface or Pipe collection. It can be used to relate information about those objects, but because it can also relate to something like "Don't Dig Here!" it falls into the General category. The General collection has three components (or branches):

Multipurpose Styles These styles are used in many objects to control the display of component objects. The Marker Styles and Link Styles collections are typically used in cross-sectional views, whereas the Feature Line Styles collection is used in grading and other commands. Figure 1.10 shows the collection of multipurpose styles and some of the marker styles that ship with the product.

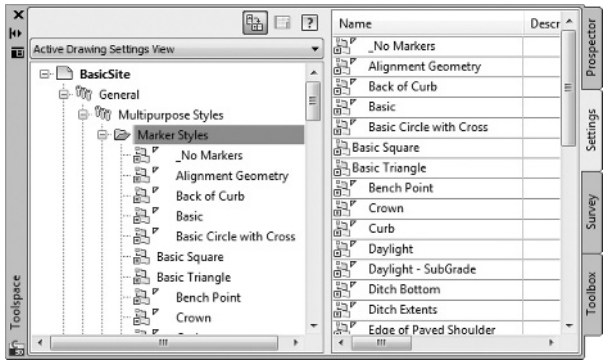


FIGURE 1.10 General multipurpose styles and some marker styles

Label Styles The Label Styles collection allows Civil 3D users to place general text notes or label single entities outside the parcel network while still taking advantage of Civil 3D's flexibility and scaling properties. With the various label styles shown in Figure 1.11, you can get some idea of their usage.

Because building label styles is a critical part of producing plans with Civil 3D, Chapter 19, "Styles," looks at how to build a new basic label and some of the common components that appear in every label style throughout the product.

Commands Almost every branch in the Settings tree contains a `Commands` folder. Expanding this folder, as shown in Figure 1.12, shows you the typical long, unspaced command names that refer to the parent object.

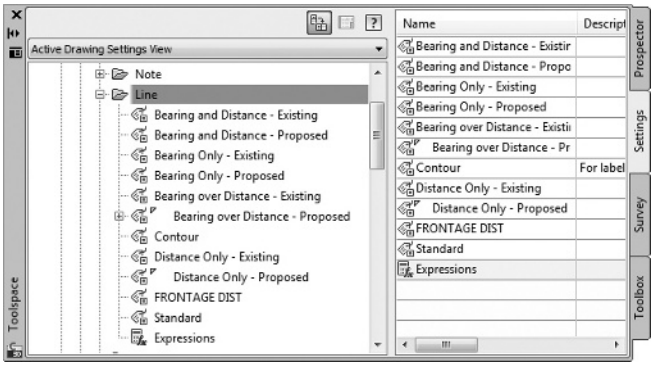


FIGURE 1.11
Line label styles

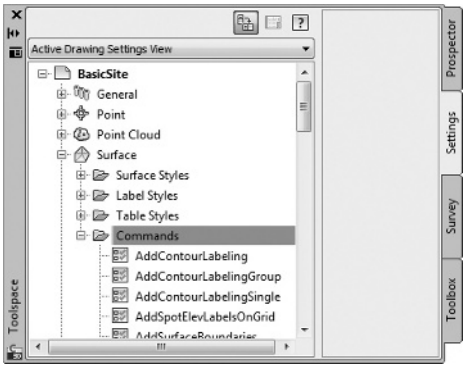


FIGURE 1.12
Surface command settings in Toolspace

SURVEY

The Survey palette is displayed optionally and controls the use of the survey, equipment, and figure prefix databases. Survey is an essential part of land-development projects. Because of the complex nature of this tab, all of Chapter 2, "Survey," is devoted to it.

TOOLBOX

The Toolbox is a launching point for add-ons and reporting functions. To access the Toolbox, from the Home tab in the Ribbon, select Toolspace ➢ Palettes ➢ Toolbox. Out of the box, the Toolbox contains reports created by Autodesk, but you can expand its functionality to include your own macros or reports. The buttons on the top of the Toolbox, shown in Figure 1.13, allow you to customize the report settings and add new content.

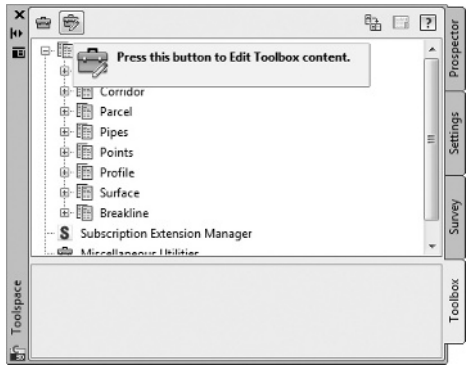


FIGURE 1.13
The Toolbox palette with the Edit Toolbox Content button

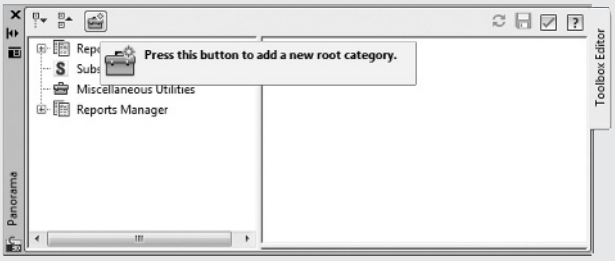
Real World Scenario

A TOOLBOX BUILT JUST FOR YOU

You can edit the Toolbox content and the Report Settings by selecting the desired tool, right-clicking, and then executing. Don't limit yourself to the default reports that ship in the Toolbox, though. Many firms find that adding in-house customizations to the Toolbox gives them better results and is more easily managed at a central level than by customizing via the AutoCAD custom user interface (CUI) and workspace functionality.

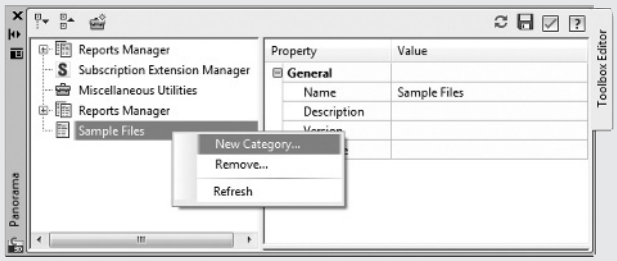
Let's add one of the sample Civil 3D Visual Basic Application (VBA) macros to a new Toolbox:

1. Click the Edit Toolbox Content button (shown in Figure 1.13) to open the Toolbox Editor in Panorama.
2. Click the button shown here to add a new root category.

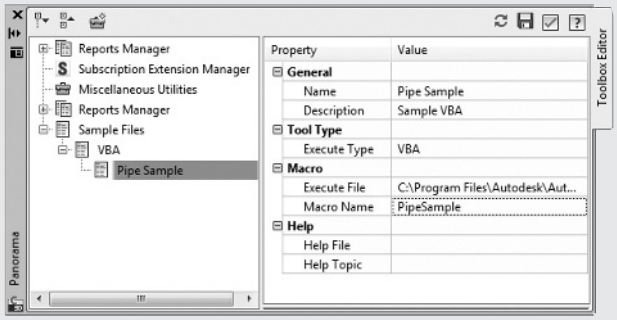


3. Click the Root Category1 toolbox that appears. The name will appear in the preview area, where you can edit it. Change the name to **Sample Files**, and press ↵.

4. Right-click the Sample Files toolbox, and select New Category as shown here.



5. Expand the Sample Files toolbox to view the new category, and then click the name to edit it in the preview area. Change the name to **VBA**, and press ↵.
6. Right-click the VBA category, and select New Tool.
7. Expand the VBA category to view the new tool, and then click the name to edit it in the preview area. Change its name to **Pipe Sample**.
8. Change the description to **Sample VBA**.
9. Working down through the properties in the preview area, select VBA in the drop-down menu in the Execute Type field.
10. Click in the Execute File field, and then click the More button.
11. Browse to `C:\Program Files\Autocad Civil 3D 2012\Sample\Civil 3D API\COM\Vba\Pipe\`, and select the file `PipeSample.dvb`.
12. Click Open.
13. Click in the Macro Name text field, and type **PipeSample** as shown here.



14. Click the green check box at the upper right to dismiss the editor.
15. You will be asked, "Would you like to apply those changes now?" Select Yes.

You've now added that sample VBA macro to your Toolbox. By adding commonly used macros and custom reports to your Toolbox, you can keep them handy without modifying the rest of your Civil 3D interface or programming buttons. It's just one more way to create an interface and toolset for the way you work.

Panorama

The Panorama window is Civil 3D's feedback and tabular editing mechanism. It's designed to be a common interface for a number of different Civil 3D–related tasks, and you can use it to provide information about the creation of profile views, to edit pipe or structure information, or to run basic volume analysis between two surfaces. For an example of Panorama in action, change to the View tab, and then select Palettes ➢ Event Viewer. You'll explore and use Panorama more during this book's discussion of specific objects and tasks.

Running Out of Screen Real Estate?

It's a good idea to turn on Panorama using this technique and then drag it to the side so you always see any new information. Although it's possible to turn it off, doing so isn't recommended—you won't know when Civil 3D is trying to tell you something! Place Panorama on your second monitor (now you see why you need to have a second monitor, don't you?), and you'll always be up-to-date with your Civil 3D model.

And in case you missed it, you were using Panorama when you added the sample VBA macro in the previous exercise.

Ribbon

As with AutoCAD, the Ribbon is the primary interface for accessing Civil 3D commands and features. When you select an AutoCAD Civil 3D object, the Ribbon displays commands and features related to that object. If several object types are selected, the Multiple contextual tab is displayed. Use the following procedure to familiarize yourself with the Ribbon:

1. Open the `BasicSite.dwg`, which you will find at `www.sybex.com/go/masteringcivil3d2012`.
2. Select one of the parcel labels (the labels in the middle of the lot areas).
3. Notice that the Labels & Tables, General Tools, Modify, and Launch Pad tabs are displayed, as shown in Figure 1.14.
4. Select a parcel line and notice the display of the Multiple contextual tab.
5. Use the Esc key to cancel all selections.
6. Reselect a parcel line. Select the down arrow next to the Modify panel. Using the pin at the bottom-left corner of the panel, pin the panel open.
7. Select the Properties command in the General Tools panel to open the AutoCAD Properties palette. Notice that the Modify panel remains opened and pinned.

Styles and More Styles

Civil 3D uses styles to change the look and feel of objects and labels. Throughout this book, you will see many styles. For a better look at styles, refer to Chapter 19.

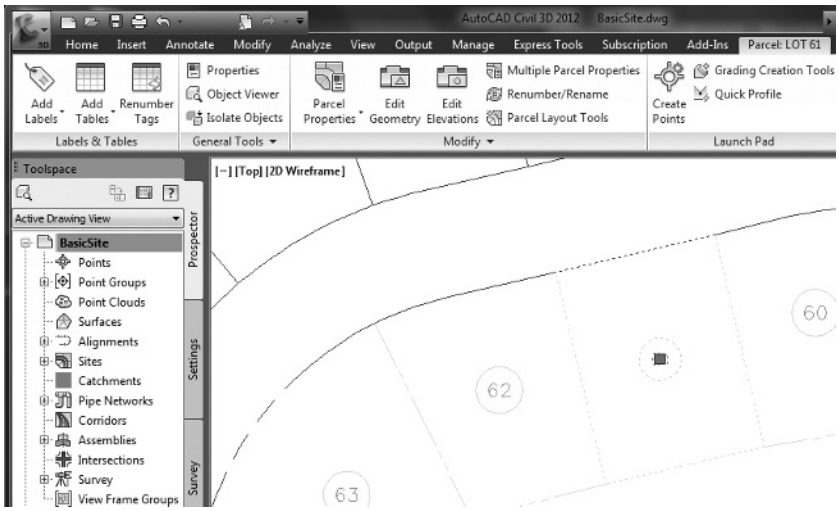


FIGURE 1.14 The context-sensitive Ribbon

Labeling Lines and Curves

You can draw lines many ways in an AutoCAD-based environment. The tools found on the Draw panel of the Home tab create lines that are no more intelligent than those created by the standard AutoCAD Line command. How the Civil 3D lines differ from those created by the regular Line command isn't in the resulting entity, but in the process of creating them. Figure 1.15 shows the available line commands.

Note that you can switch between any of the Line commands without exiting the command. For example, if your first location is a point object, use Line By Point Object; then, without leaving the command, go back to the Lines/Curves menu and choose any Line or Curve command to continue creating your linework. You can also press the Esc key once, while in a Lines/Curves menu command, to resume the regular Line command.

Coordinate Line Commands

The next few commands discussed in this section help you create a line using Civil 3D points and/or coordinate inputs. Each command requires you to specify a Civil 3D point, a location in space, or a typed coordinate input. These Line tools are useful when your drawing includes Civil 3D points that will serve as a foundation for linework, such as the edge of pavement shots, wetlands lines, or any other points you'd like to connect with a line.

LINE COMMAND

The Create Line command on the Draw panel of the Home tab issues the standard AutoCAD Line command. It's equivalent to typing **line** on the command line or clicking the Line tool on the Draw toolbar.

CREATE LINE BY POINT # RANGE COMMAND

CERT OBJECTIVE

The Create Line By Point # Range command prompts you for a point number. You can type in an individual point number, press ↵, and then type in another point number. A line is drawn connecting those two points. You can also type in a range of points, such as **640-644**. Civil 3D draws

a line that connects those lines in numerical order—from 640 to 641, and so on (see Figure 1.16). This order won't give you the desired linework for edge of asphalt, for example.

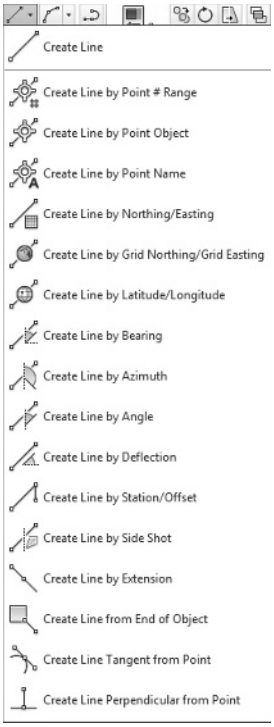

Create Line
Create Line by Point # Range
Create Line by Point Object
Create Line by Point Name
Create Line by Northing/Easting
Create Line by Grid Northing/Grid Easting
Create Line by Latitude/Longitude
Create Line by Bearing
Create Line by Azimuth
Create Line by Angle
Create Line by Deflection
Create Line by Station/Offset
Create Line by Side Shot
Create Line by Extension
Create Line from End of Object
Create Line Tangent from Point
Create Line Perpendicular from Point

FIGURE 1.15
Line creation tools

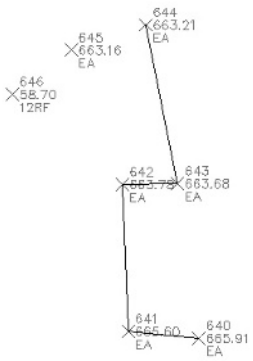


FIGURE 1.16
A line created using 640-644 as input

Alternatively, you can enter a list of points such as **640, 643, 644** (Figure 1.17). Civil 3D draws a line that connects the point numbers in the order of input. This approach is useful when your points were taken in a zigzag pattern (as is commonly the case when cross-sectioning pavement), or when your points appear so far apart in the AutoCAD display that they can't be readily identified.

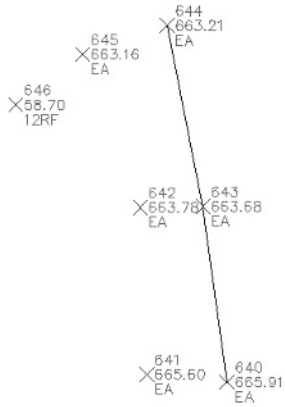


FIGURE 1.17
A line created using 640, 643, 644 as input

CREATE LINE BY POINT OBJECT COMMAND

The Create Line By Point Object command prompts you to select a point object. To select a point object, locate the desired start point and click any part of the point. This tool is similar to using the regular Line command and a Node object snap (also known as osnap).

CREATE LINE BY POINT NAME COMMAND

CERT OBJECTIVE

The Create Line By Point Name command prompts you for a point name. A *point name* is a field in Point properties, not unlike the point number or description. The difference between a point name and a *point description* is that a point name must be unique. It is important to note that some survey instruments name points rather than number points as is the norm.

To use this command, enter the names of the points you want to connect with linework.

CREATE LINE BY NORTHING/EASTING AND CREATE LINE BY GRID NORTHING/EASTING COMMANDS

The Create Line by Northing/Easting and Create Line By Grid Northing/Easting commands let you input northing (y) and easting (x) coordinates as endpoints for your linework. The Create Line By Grid Northing/Easting command requires that the drawing have an assigned coordinate system. This command can be useful when working with known surveyed points or features in a state plane coordinate system (SPCS).

CREATE LINE BY LATITUDE/LONGITUDE COMMAND

The Create Line By Latitude/Longitude command prompts you for geographic coordinates to use as endpoints for your linework. This command also requires that the drawing have an assigned coordinate system. For example, if your drawing has been assigned Delaware State Plane NAD83 US Feet and you execute this command, your Latitude/Longitude inputs are translated into the appropriate location in your state plane drawing. This command can be useful when you are drawing lines between waypoints collected with a standard handheld GPS unit.

Direction-Based Line Commands

The next few commands help you specify the direction of a line. Each of these commands requires you to choose a start point for your line before you can specify the line direction. You can specify your start point by physically choosing a location, using an osnap, or using one of the point-related line commands discussed earlier.

Create Line By Bearing Command

The Create Line By Bearing command will likely be one of your most frequently used line commands.

This command prompts you for a start point, followed by prompts to input the Quadrant, Bearing, and Distance values. You can enter values on the command line for each input, or you can graphically choose inputs by picking them on screen. The glyphs at each stage of input guide you in any graphical selections. After creating one line, you can continue drawing lines by bearing, or you can switch to any other method by clicking one of the other Line By commands on the Draw panel (see Figure 1.18).

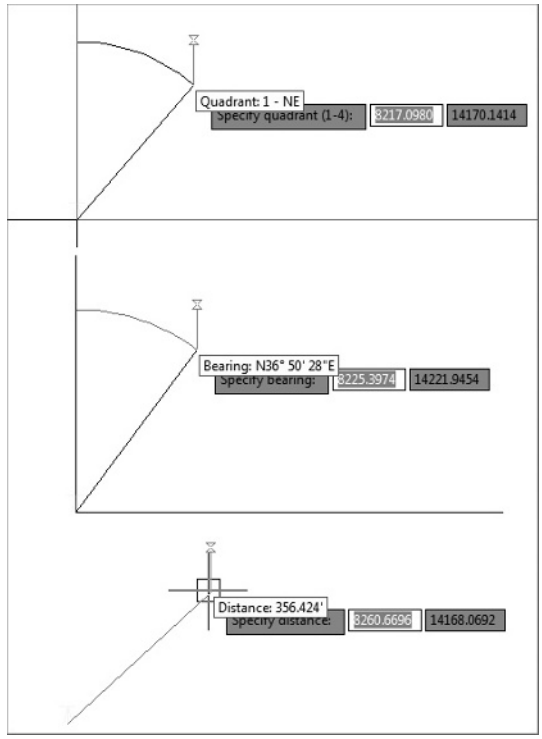
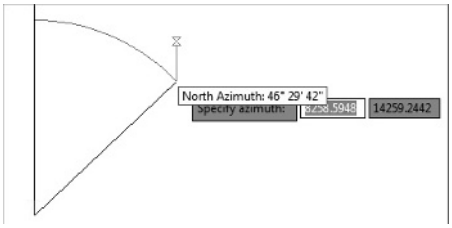


Figure 1.18
The tooltips for a quadrant (top), a bearing (middle), and a distance (bottom)

Create Line By Azimuth Command

The Create Line By Azimuth command prompts you for a start point, followed by a north azimuth, and then a distance (Figure 1.19).

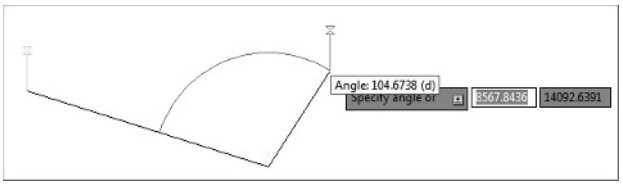
FIGURE 1.19
The tooltip for the Create Line by Azimuth command



CREATE LINE BY ANGLE COMMAND

The Create Line By Angle command prompts you for a turned angle and then a distance (Figure 1.20). This command is useful when you're creating linework from angles right (in lieu of angles left) and distances recorded in a traditional handwritten field book (required by law in many states).

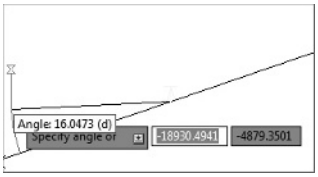
FIGURE 1.20
The tooltip for the Create Line By Angle command



CREATE LINE BY DEFLECTION COMMAND

By definition, a *deflection angle* is the angle turned from the extension of a line from the backsight extending through an instrument. Although this isn't the most frequently used surveying tool in this day of data collectors and GPSs, on some occasions you may need to create this type of line. When you use the Create Line By Deflection command, the command line and tooltips prompt you for a deflection angle followed by a distance (Figure 1.21). In some cases, deflection angles are recorded in the field in lieu of right angles.

FIGURE 1.21
The tooltips for the Create Line By Deflection command



CREATE LINE BY STATION/OFFSET COMMAND

To use the Create Line By Station/Offset command, you must have a Civil 3D Alignment object in your drawing. The line created from this command allows you to start and/or end a line on the basis of a station and offset from an alignment.

You're prompted to choose the alignment and then input a station and offset value. The line *begins* at the station and offset value. On the basis of the tooltips, you might expect the line to be drawn from the alignment station at offset zero and out to the alignment station at the input offset. This isn't the case.

When prompted for the station, you're given a tooltip that tracks your position along the alignment, as shown in Figure 1.22. You can graphically choose a station location by picking in the drawing (including using your osnaps to assist you in locking down the station of a specific feature). Alternatively, you can enter a station value on the command line.

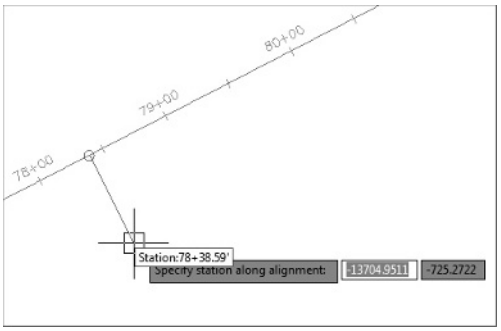


FIGURE 1.22
The Create Line By Station/Offset command provides a tooltip for you to track stationing along the alignment.

Once you've selected the station, you're given a tooltip that is locked on that particular station and tracks your offset from the alignment (see Figure 1.23). You can graphically choose an offset by picking in the drawing, or you can type an offset value on the command line.

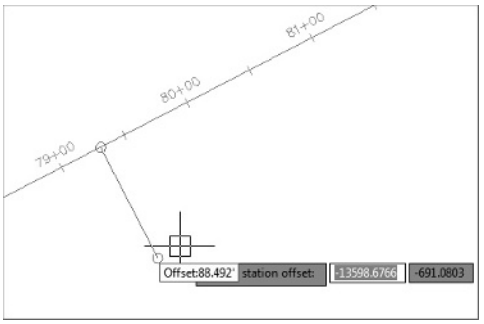


FIGURE 1.23
The Create Line By Station/Offset command provides a tooltip that helps you track the offset from the alignment.

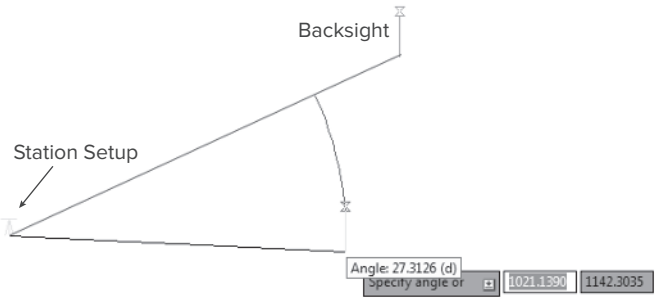
CREATE LINE BY SIDE SHOT COMMAND

The Create Line By Side Shot command lets you occupy one point, designate a backsight, and draw a line that has endpoints relative to that point. The occupied point represents the setup of your surveying station, whereas the second point represents your surveying backsight. This tool may be most useful when you're creating stakeout information or re-creating data from field notes. If you know where your crew set up and you have their side-shot angle measurements but you don't have electronic information to download, this tool can help. To specify locations relative to your occupied point, you can specify the angle, bearing, deflection, or azimuth on the command line or pick locations in your drawing. In some cases, it is more appropriate to supply a survey crew with handwritten notes regarding backsights, foresights, angles right, and distances rather than upload the same information to a data collector.

While the command is active, you can toggle between angle, bearing, deflection, and azimuth by following the command-line prompts.

When you're using the Create Line By Side Shot command, you're given a setup glyph at your occupied point, a backsight glyph, and a tooltip to track the angle, bearing, deflection, or azimuth of the side shot (see Figure 1.24). You can toggle between these options by following the command-line prompts.

FIGURE 1.24
The tooltip for the Create Line By Side Shot command tracks the angle, bearing, deflection, or azimuth of the side shot.



CREATE LINE EXTENSION COMMAND

The Create Line Extension command is similar to the AutoCAD Lengthen command. This command allows you to add length to a line or specify a desired total length of the line.

You are first prompted to choose a line. The command line then displays the prompt `Specify distance to change, or [Total]`. The distance you specify is added to the existing length of the line. The command draws the line appropriately and provides a short summary report on that line. The summary report in Figure 1.25 indicates that the beginning line length was 100″ and that an additional distance of 50″ was specified with the Line Extension command. It is important to note that in some cases, it may be more desirable to create a line by a turned angle or deflection of 180 degrees so as not to disturb linework originally created from existing legally recorded documents.

FIGURE 1.25
The Create Line Extension command provides a summary of the changes to the line.

```
Select line object:
Specify distance to change, or [Total]: 50

----------------------------------------------------------------------
                              LINE DATA
----------------------------------------------------------------------
Begin . . . . .  North: 1216.9486'          East: -617.9729'
End . . . . . .  North: 1279.6199'          East: -481.6927'
              Distance: 150.000'        Course: N65° 18' 13"E
```

If instead you specify a total distance on the command line, the length of the line is changed to the distance you specify. The summary report shown in Figure 1.26 indicates that the beginning of the line was the same as in Figure 1.26 but with a total length of only 100″.

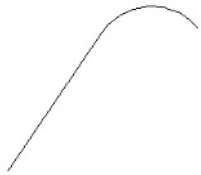
FIGURE 1.26
The summary report on a line where the command specified a total distance

```
Command: _AeccLineExtension
Select line object:
Specify distance to change, or [Total]: t

Specify total distance, or [Change]: 100

----------------------------------------------------------------------
                              LINE DATA
----------------------------------------------------------------------
Begin . . . . .  North: 1216.9486'          East: -617.9729'
End . . . . . .  North: 1258.7295'          East: -527.1194'
              Distance: 100.000'        Course: N65° 18' 13"E
```

Create Line From End Of Object Command

The Create Line From End Of Object command lets you draw a line tangent to the end of a line or arc of your choosing. Most commonly, you'll use this tool when re-creating deeds or other survey work where you have to specify a line that continues a tangent from an arc (see Figure 1.27).

Figure 1.27
The Create Line From End Of Object command lets you add a tangent line to the end of an arc.

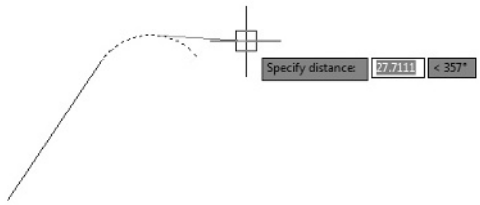


Create Line Tangent From Point Command

CERT OBJECTIVE

The Create Line Tangent from Point command is similar to the Create Line From End Of Object command, but Create Line Tangent From Point allows you to choose a point of tangency that isn't the endpoint of the line or arc (see Figure 1.28).

Figure 1.28
The Create Line Tangent From Point command can place a line tangent at the midpoint of an arc (or line).



Create Line Perpendicular From Point Command

Using the Create Line Perpendicular From Point command, you can specify that you'd like a line drawn perpendicular to any point of your choosing. In the example shown in Figure 1.29, a line is drawn perpendicular to the endpoint of the arc. This command can be useful when the distance from a known monument perpendicular to a legally platted line must be labeled in a drawing.

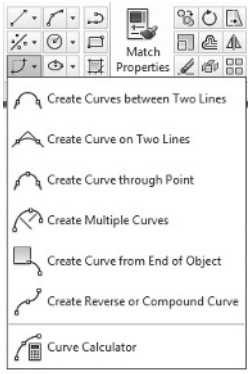
Figure 1.29
A perpendicular line is drawn from the endpoint of an arc, using the Create Line Perpendicular From Point command.

Creating Curves

Curves are an important part of surveying and engineering geometry. In truth, curves are no different from AutoCAD arcs. What makes the curve commands different than the basic AutoCAD commands isn't the resulting arc entity but the inputs used to draw the arc. Civil 3D wants you to provide directions to the arc commands using land surveying terminology rather than with generic Cartesian parameters.

Figure 1.30 shows the Create Curves menu options.

FIGURE 1.30
Create Curves commands


Match Properties
Create Curves between Two Lines
Create Curve on Two Lines
Create Curve through Point
Create Multiple Curves
Create Curve from End of Object
Create Reverse or Compound Curve
Curve Calculator

Standard Curves

When re-creating legal descriptions for roads, easements, and properties, engineers, surveyors, and mappers often encounter a variety of curves. Although standard AutoCAD arc commands could draw these arcs, the AutoCAD arc inputs are designed to be generic to all industries. The following curve commands have been designed to provide an interface that more closely matches land surveying, mapping, and engineering language.

Create Curve Between Two Lines Command

The Create Curve Between Two Lines command is much like the standard AutoCAD Fillet command, except that you aren't limited to a radius parameter. The command draws a curve that is tangent to two lines of your choosing. This command also trims or extends the original tangents so their endpoints coincide with the curve endpoints. The lines are trimmed or extended to the resulting PC (point of curve, which is the beginning of a curve) and PT (point of tangency, or the end of a curve). You may find this command most useful when you're creating foundation geometry for road alignments, parcel boundary curves, and similar situations.

The command prompts you to choose the first tangent and then the second tangent. The command line gives the following prompt:

```
Select entry [Tangent/External/Degree/Chord/Length/Mid-Ordinate/
miN-dist/Radius]<Radius>:
```

Pressing ↵ at this prompt lets you input your desired radius. As with standard AutoCAD commands, pressing T changes the input parameter to Tangent, pressing C changes the input parameter to Chord, and so on.

As with the Fillet command, your inputs must be geometrically possible. For example, your two lines must allow for a curve of your specifications to be drawn while remaining tangent to both. Figure 1.31 shows two lines with a 25″ radius curve drawn between them. Note that the tangents have been trimmed so their endpoints coincide with the endpoints of the curve. If either line had been too short to meet the endpoint of the curve, then that line would have been extended.

FIGURE 1.31
Two lines using the Create Curve Between Two Lines command

CREATE CURVE ON TWO LINES COMMAND

The Create Curve On Two Lines command is identical to the Create Curve Between Two Lines command, except that the Create Curve On Two Lines command leaves the chosen tangents intact. The lines aren't trimmed or extended to the resulting PC and PT of the curve.

Figure 1.32, for example, shows two lines with a 25″ radius curve drawn on them. The tangents haven't been trimmed and instead remain exactly as they were drawn before the Create Curve On Two Lines command was executed.

FIGURE 1.32
The original lines stay the same after you execute the Create Curve On Two Lines command.

CREATE CURVE THROUGH POINT COMMAND

The Create Curve Through Point command lets you choose two tangents for your curve followed by a pass-through point. This tool is most useful when you don't know the radius, length, or other curve parameters but you have two tangents and a target location. It isn't necessary that the pass-through location be a true point object; it can be any location of your choosing.

This command also trims or extends the original tangents so their endpoints coincide with the curve endpoints. The lines are trimmed or extended to the resulting PC and PT of the curve.

Figure 1.33, for example, shows two lines and a desired pass-through point. Using the Create Curve Through Point command allows you to draw a curve that is tangent to both lines and that passes through the desired point. In this case, the tangents have been trimmed to the PC and PT of the curve.

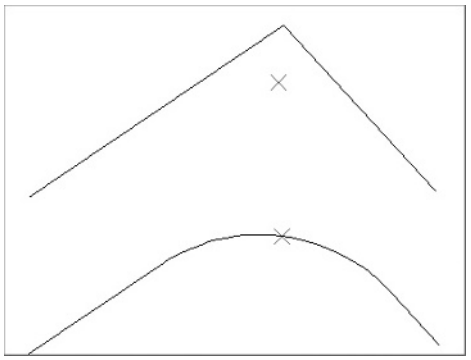


FIGURE 1.33
The first image shows two lines with a desired pass-through point. In the second image, the Create Curve Through Point command draws a curve that is tangent to both lines and passes through the chosen point.

CREATE MULTIPLE CURVES COMMAND

The Create Multiple Curves command lets you create several curves that are tangentially connected. The resulting curves have an effect similar to an alignment spiral section. This command can be useful when you are re-creating railway track geometry based on field survey data.

The command prompts you for the two tangents. Then, the command line prompts you as follows:

```
Enter Number of Curves:
```

The command allows for up to 10 curves between tangents.

One of your curves must have a flexible length that's determined on the basis of the lengths, radii, and geometric constraints of the other curves. Curves are counted clockwise, so enter the number of your flexible curve:

```
Enter Floating Curve #:
Enter the length and radii for all your curves:
Enter curve 1 Radius:
Enter curve 1 Length:
```

The floating curve number will prompt you for a radius but not a length.

As with all other curve commands, the specified geometry must be possible. If the command can't find a solution on the basis of your length and radius inputs, it returns no solution (see Figure 1.34).

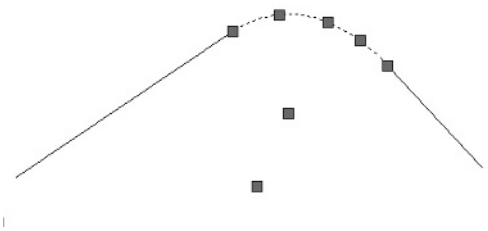


FIGURE 1.34
Two curves were specified with the #2 curve designated as the floating curve.

Create Curve From End Of Object Command

The Create Curve From End Of Object command enables you to draw a curve tangent to the end of your chosen line or arc.

The command prompts you to choose an object to serve as the beginning of your curve. You can then specify a radius and an additional parameter (such as Delta or Length) for the curve or the endpoint of the resulting curve chord (see Figure 1.35).

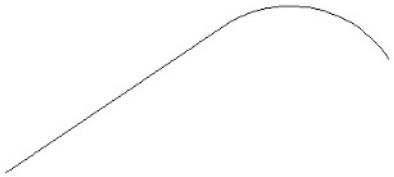


Figure 1.35
A curve, with a 25″ radius and a 30″ length, drawn from the end of a line

Create Reverse Or Compound Curves Command

The Create Reverse Or Compound Curves command allows you to add additional curves to the end of an existing curve. Reverse curves are drawn in the opposite direction (i.e., a curve to the right tangent to a curve to the left) from the original curve to form an S shape. In contrast, compound curves are drawn in the same direction as the original curve (see Figure 1.36). This tool can be useful when you are re-creating a legal description of a road alignment that contains reverse and/or compound curves.

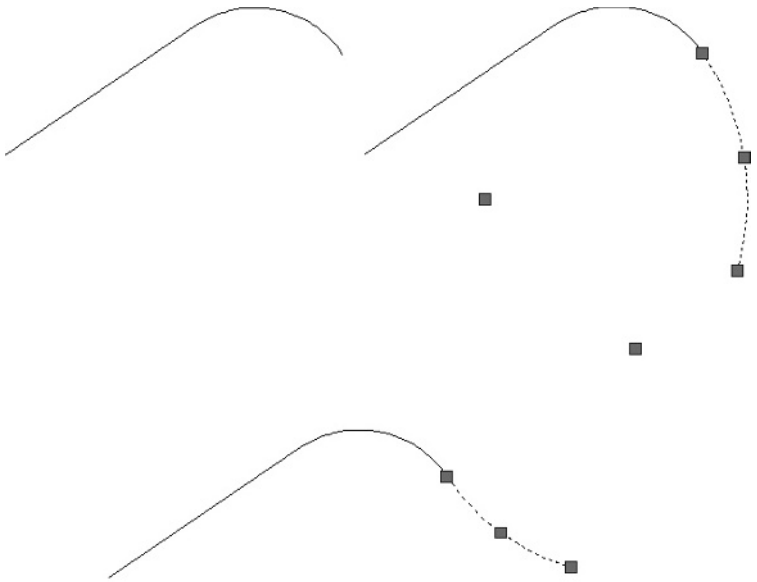


Figure 1.36
A tangent and curve before adding a reverse or compound curve (left); a compound curve drawn from the end of the original curve (right); and a reverse curve drawn from the end of the original curve (bottom)

Re-creating a Deed Using Line and Curve Tools

This exercise will help you apply some of the tools you've learned so far to reconstruct the overall parcel that will be used as the sample exercises for the majority of the book.

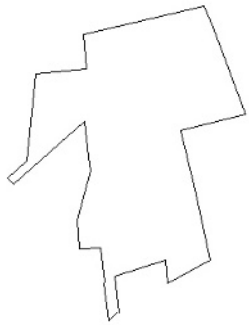
```
From Point of Beginning
South 44 degrees 54 minutes 15 seconds West 68.64 feet to a point
North 07 degrees 05 minutes 24 seconds East 217.80 feet to a point
North 72 degrees 12 minutes 10 seconds East 4.23 feet to a point
North 05 degrees 53 minutes 27 seconds East 201.09 feet to a point
South 86 degrees 32 minutes 10 seconds East 121.22 feet to a point
North 03 degrees 25 minutes 51 seconds West 168.78 feet to a point
North 14 degrees 38 minutes 58 seconds East 283.16 feet to a point
North 07 degrees 19 minutes 22 seconds West 79.64 feet to a point
North 07 degrees 04 minutes 00 seconds West 205.45 feet to a point
South 46 degrees 24 minutes 36 seconds West 121.05 feet to a point
South 48 degrees 31 minutes 20 seconds West 414.66 feet to a point
North 49 degrees 29 minutes 56 seconds West 50.80 feet to a point
North 48 degrees 37 minutes 57 seconds East 150.29 feet to a point
North 05 degrees 39 minutes 50 seconds East 497.28 feet to a point
North 84 degrees 20 minutes 01 seconds East 290.33 feet to a point
North 05 degrees 20 minutes 48 seconds West 195.08 feet to a point
North 76 degrees 46 minutes 10 seconds East 701.96 feet to a point
South 23 degrees 42 minutes 48 seconds East 130.68 feet to a point
South 20 degrees 13 minutes 35 seconds East 526.50 feet to a point
South 76 degrees 04 minutes 14 seconds West 379.96 feet to a point
South 13 degrees 22 minutes 41 seconds East 320.08 feet to a point
South 12 degrees 36 minutes 45 seconds East 159.86 feet to a point
South 12 degrees 21 minutes 15 seconds East 274.32 feet to a point
South 61 degrees 15 minutes 09 seconds West 272.81 feet to a point
North 06 degrees 15 minutes 30 seconds West 131.45 feet to a point
South 72 degrees 12 minutes 22 seconds West 301.60 feet to a point
South 06 degrees 58 minutes 04 seconds East 206.04 feet to a point
Returning to Point of Beginning
The resulting enclosure should be: 26.25 acres (more or less)
```

Follow these steps:

1. Open the `Deed Create Start.dwg` file, which you can download from this book's web page at `www.sybex.com/masteringcivil3d2012`.
2. Turn off Dynamic Input by pressing F12, or by toggling the icon off at the status bar.
3. From the Draw panel on the Home tab, select the Line drop-down and choose the Create Line By Bearing command.
4. At the `Select first point:` prompt, select any location in the drawing to begin the first line.
5. At the `>>Specify quadrant (1-4):` prompt, enter **3** to specify the SW quadrant, and then press ↵.

6. At the `>>Specify bearing:` prompt, enter **44.5415**, and press ↵.
7. At the `>>Specify distance:` prompt, enter **68.64**, and press ↵.
8. Repeat steps 4 through 6 for the rest of the courses.
9. Press Esc to exit the Create Line By Bearing command.
10. The finished linework should look like Figure 1.37. There will be an error of closure of 10.0016". Typically, rounding errors can cause an error in closure. Perhaps reworking the deed holding a different rounding value would improve your results. Consult your office survey expert about how this would be handled in house, and refer to Chapter 2 for more information about traverse adjustment and similar tools.
11. Save your drawing. You'll need it for the next exercise.

FIGURE 1.37
The finished linework



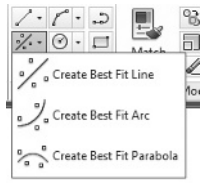
Best Fit Entities

Although engineers and surveyors do their best to make their work an exact science, sometimes tools like the Best Fit Entities are required.

Roads in many parts of the world have no defined alignment. They may have been old carriage roads or cart paths from hundreds of years ago that evolved into automobile roads. Surveyors and engineers are often called to help establish official alignments, vertical alignments, and right-of-way lines for such roads on the basis of a best fit of surveyed centerline data.

Other examples for using Best Fit Entities include property lines of agreement, road rehabilitation projects, and other cases where existing survey information must be approximated into "real" engineering geometry (see Figure 1.38).

FIGURE 1.38
The Create Best Fit Entities menu options



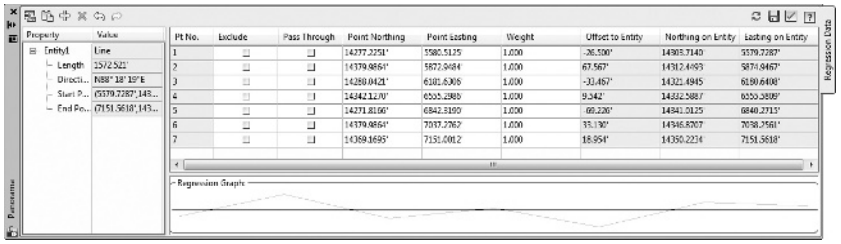
Create Best Fit Line Command

The Create Best Fit Line command under the Best Fit drop-down on the Draw panel takes a series of Civil 3D points, AutoCAD points, entities, or drawing locations and draws a single best-fit line segment from this information. In Figure 1.39, for example, the Create Best Fit Line command draws a best-fit line through a series of points that aren't quite collinear. Note that the best-fit line will change as more points are picked.

Figure 1.39
A preview line drawn through points that aren't quite collinear

Once you've selected your points, a Panorama window appears with a regression data chart showing information about each point you chose, as shown in Figure 1.40.

Figure 1.40
The Panorama window lets you optimize your best fit.

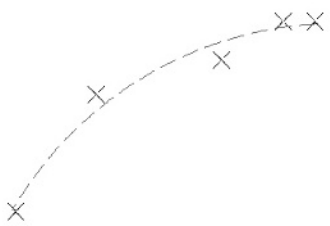


This interface allows you to optimize your best fit by adding more points, selecting the check box in the Pass Through column to force one of your points on the line, or adjusting the value under the Weight column.

Create Best Fit Arc Command

The Create Best Fit Arc command under the Best Fit drop-down works identically to the Create Best Fit Line command, except that the resulting entity is a single arc segment as opposed to a single line segment (see Figure 1.41).

Figure 1.41
A curve created by best fit



Create Best Fit Parabola Command

The Create Parabola command under the Create Best Fit Entities option works in a similar way to the line and arc commands just described. This command is most useful when you have a Triangulated Irregular Network (also known as TIN) sampled or surveyed road information and you'd like to replicate true vertical curves for your design information.

After you select this command, the Parabola By Best Fit dialog appears (see Figure 1.42).

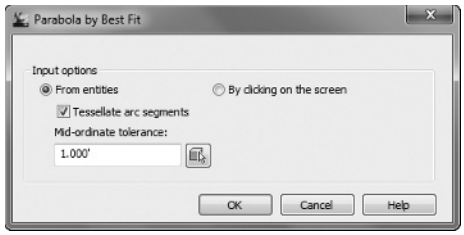


Figure 1.42
The Parabola By Best Fit dialog

You can select inputs from entities (such as lines, arcs, polylines, or profile objects) or by picking on screen. The command then draws a best-fit parabola on the basis of this information. In Figure 1.43, the shots were represented by AutoCAD points; more points were added by selecting the By Clicking On The Screen option and using the Node osnap to pick each point.

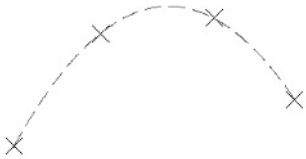


Figure 1.43
The best-fit preview line changes as more points are picked.

Once you've selected your points, a Panorama window appears, showing information about each point you chose. Also note the information in the right pane regarding K-value, curve length, grades, and so forth.

In this interface (shown in Figure 1.44), you can optimize your K-value, length, and other values by adding more points, selecting the check box in the Pass Through column to force one of your points on the line, or adjusting the value under the Weight column.

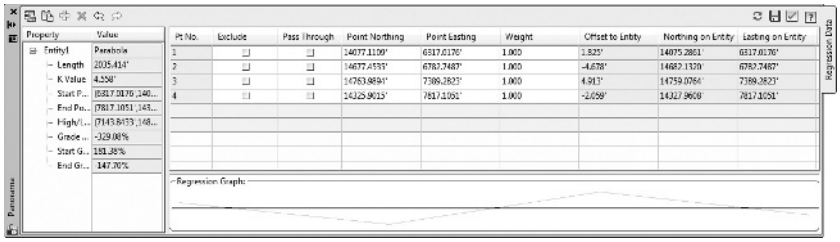


Figure 1.44
The Panorama window lets you make adjustments to your best-fit parabola.

Attach Multiple Entities

The Attach Multiple Entities command (found on the Home tab and extended Draw panel pull-down) is a combination of the Line From End Of Object command and the Curve From End Of Object command. This command is most useful for reconstructing deeds or road alignments from legal descriptions when each entity is tangent to the previous entity. Using this command saves you time because you don't have to constantly switch between the Line From End Of Object command and the Curve From End Of Object command (see Figure 1.45).

FIGURE 1.45
The Attach Multiple Entities command draws a series of lines and arcs so that each segment is tangent to the previous one.

The Curve Calculator

CERT OBJECTIVE

Sometimes you may not have enough information to draw a curve properly. Although many of the curve-creation tools assist you in calculating the curve parameters, you may find an occasion where the deed you're working with is incomplete.

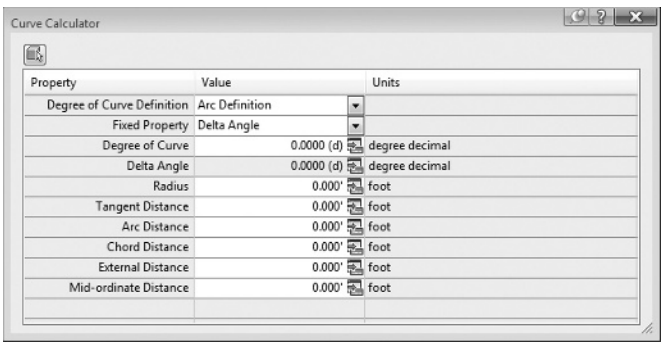
The Curve Calculator found in the Curves drop-down on the Draw panel helps you calculate a full collection of curve parameters on the basis of your known values and constraints. The units used in the Curve Calculator match the units assigned in your Drawing Settings.

The Curve Calculator can remain open on your screen while you're working through commands. You can send any value in the Calculator to the command line by clicking the button next to that value (see Figure 1.46).

The button at the upper left of the Curve Calculator inherits the arc properties from an existing arc in the drawing, and the drop-down menu in the Degree Of Curve Definition selection field allows you to choose whether to calculate parameters for an arc or a chord definition.

The drop-down menu in the Fixed Property selection field also gives you the choice of fixing your radius or delta value when calculating the values for an arc or a chord, respectively (see Figure 1.47). The parameter chosen as the fixed value is held constant as additional parameters are calculated.

FIGURE 1.46
The Curve Calculator



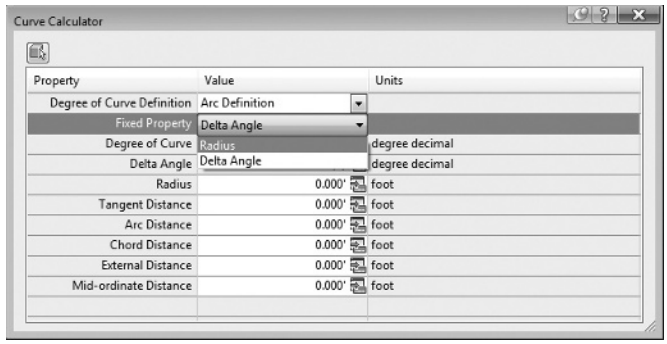


FIGURE 1.47
The Fixed Property drop-down menu gives you the choice of fixing your radius or delta value.

As explained previously, you can send any value in the Curve Calculator to the command line using the button next to that value. This ability is most useful while you're active in a curve command and would like to use a certain parameter value to complete the command.

Adding Line and Curve Labels

CERT OBJECTIVE

Although most robust labeling of site geometry is handled using Parcel or Alignment labels, limited line- and curve-annotation tools are available in Civil 3D. The line and curve labels are composed much the same way as other Civil 3D labels, with marked similarities to Parcel and Alignment Segment labels.

Our next exercise leads you through labeling the deed you re-created earlier in this chapter:

1. Continue working in the `Deed Create Start.dwg` file.
2. Click the Labels button in the Labels & Tables panel on the Annotate tab. The Add Labels dialog appears, as shown in Figure 1.48.
3. Choose Line And Curve from the Feature drop-down menu.
4. Choose Multiple Segment from the Label Type drop-down menu. The Multiple Segment option places the label at the midpoint of each selected line or arc.
5. Confirm that Line Label Style is set to Bearing Over Distance and that Curve Label Style is set to Distance-Radius And Delta.
6. Click the Add button.

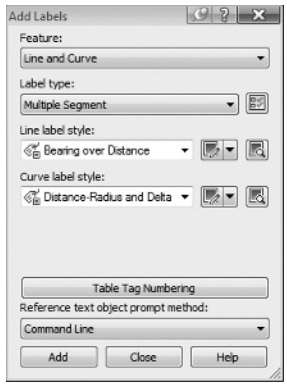


FIGURE 1.48
The Add Labels dialog, set to Multiple Segment Labels

Where Is Delta?

In the Text Component Editor for a curve label, the value that most people would refer to as a delta angle is called the General Segment Total Angle. To insert the Delta symbol in a label, type **\U+0394** in the Text Editor window on the right side of the Text Component Editor dialog.

7. At the `Select Entity:` prompt, select each line and arc that you drew in the previous exercise. A label appears on each entity at its midpoint, as shown in Figure 1.49.

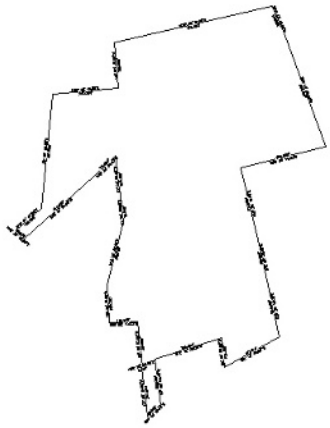


Figure 1.49
The labeled linework

8. Save the drawing—you'll need it for the next exercise.

Using Transparent Commands

In many cases, the "Create Line By…" commands in the Draw panel are the standard AutoCAD Line commands combined with the appropriate transparent commands.

A transparent command behaves somewhat similarly to an osnap command. You can't click the Endpoint button and expect anything to happen—you must be active inside another command, such as a line, an arc, or a circle command.

The same principle works for transparent commands. Once you're active in the Line command (or any AutoCAD or Civil 3D drawing command), you can choose the Bearing Distance transparent command and complete your drawing task using a bearing and distance.

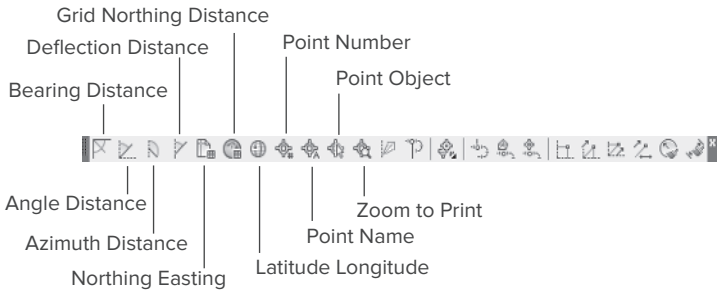
As stated earlier, the transparent commands can be used in any AutoCAD or Civil 3D drawing command, much like an osnap. For example, you can be actively drawing an alignment and use the Northing/Easting transparent command to snap to a particular coordinate, and then press Esc once and continue drawing your alignment as usual.

While a transparent command is active, you can press Esc once to leave the transparent mode but stay active in your current command. You can then choose another transparent command if you'd like. For example, you can start a line using the Endpoint osnap, activate the Angle

Distance transparent command, draw a line-by-angle distance, and then press Esc, which takes you out of angle-distance mode but keeps you in the Line command. You can then draw a few more segments using the Point Object transparent command, press Esc, and finish your line with a Perpendicular osnap.

You can activate the transparent commands using keyboard shortcuts or using the Transparent Commands toolbar. Be sure you include the Transparent Commands toolbar (shown in Figure 1.50) in all your Civil 3D and survey-oriented workspaces.

FIGURE 1.50
The Transparent Commands toolbar



The six profile-related transparent commands will be covered in Chapter 7, "Profiles and Profile Views."

Standard Transparent Commands

CERT OBJECTIVE

The transparent commands shown in Table 1.1 behave identically to their like-named counterparts from the Draw panel (discussed earlier in this chapter). The difference is that you can call up these transparent commands in any appropriate AutoCAD or Civil 3D draw command, such as a line, polyline, alignment, parcel segment, feature line, or pipe-creation command.

TABLE 1.1: The transparent commands

TOOL ICON	MENU COMMAND
	Angle Distance
	Bearing Distance
	Azimuth Distance
	Deflection Distance
	Northing Easting
	Grid Northing Easting

TABLE 1.1: The transparent commands *(CONTINUED)*

TOOL ICON	MENU COMMAND
	Latitude Longitude
	Point Number
	Point Name
	Point Object
	Zoom To Point
	Side Shot
	Station Offset

Matching Transparent Commands

You may have construction or other geometry in your drawing that you'd like to match with new lines, arcs, circles, alignments, parcel segments, or other entities.

While actively drawing an object that has a radius parameter, such as a circle, an arc, an alignment curve, or a similar object, you can choose the Match Radius transparent command and then select an object in your drawing that has your desired radius. Civil 3D draws the resulting entity with a radius identical to that of the object you chose during the command. You'll save time using this tool because you don't have to first list the radius of the original object and then manually type in that radius when prompted by your circle, arc, or alignment tool.

The Match Length transparent command works identically to the Match Radius transparent command except that it matches the length parameter of your chosen object.

The Underlying Engine

Civil 3D is part of a larger product family from Autodesk. During its earliest creation, various features and functions from other products were recognized as important to the civil engineering community. These included the obvious things such as the entire suite of AutoCAD drafting, design, modeling, and rendering tools as well as more esoteric options such as Map's GIS capabilities. An early decision was made to build Civil 3D on top of the AutoCAD Map product, which in turn is built on top of AutoCAD.

This underlying engine provides a host of options and powerful tools for the Civil 3D user. AutoCAD and Map add features with every release that change the fundamental makeup of how Civil 3D works. With the introduction of workspaces in 2006, users can now set up Civil 3D to display various tools and palettes depending on the task at hand. Creating a workspace is like having a quick-fix bag of tools ready: preliminary design calls for one set of tools, and final plan production calls for another.

Workspaces are part of a larger feature set called the *custom user interface* (referred to as CUI in the help documentation and online). As you grow familiar with Civil 3D and the various tool palettes, menus, and toolbars, be sure to explore the CUI options that are available from the Workspace toolbar.

You may have noticed that when you start typing in Civil 3D, it shows a list of the commands and set variables that begin with that letter, and as you type further, it refines that list. This is AutoCAD's new autocomplete feature. If you do not want to use this feature, you can type **AUTOCOMPLETE** and set the command to **OFF**.

Managing Civil 3D Information

The Manage tab contains many of the management tools available in Civil 3D. Many of these tools are continuations of the basic AutoCAD tools, but they are worth some discussion.

- The Data Shortcuts panel contains all the tools related to using data shortcuts. You will learn more about data shortcuts in chapter 17. "Interoperability".
- The Customization panel has the tools for manipulating the user interface and tool palettes via the Customize dialog box. You can also import and export your customized user interface (CUI). And for the real hackers, you can set aliases; for example, if you wanted to change C (which is the default keyboard shortcut for circle) to COPY, you can take care of that here.
- The Applications panel allows you to run specialized third-party applications, as well as manage Lisp files. And you thought that Lisp was dead!
- The CAD Standards panel allows someone such as a CAD Manager to set compliances for layering, allow importing of third-party drawing file layers, and, via a macro, change their layers to your company's standards automatically.
- The Action Recorder panel contains all the tools for recording and playback of keystrokes. It has been around for some time but is probably not used much in the Civil 3D world. You can record keystrokes and play them back to remedy the repetitive keystrokes one might use over and over.
- The Styles panel is new to Civil 3D 2012 and is a welcome addition. You can now import styles via a dialog box instead of the old ways of accomplishing this. And the Purge tool will look at all the styles in your drawing and allow you to remove ones that are not in use. You will learn more about these tools in Chapter 19, "Styles."

The Bottom Line

Find any Civil 3D object with just a few clicks. By using Prospector to view object data collections, you can minimize the panning and zooming that are part of working in a CAD program. When common subdivisions can have hundreds of parcels or a complex corridor can have dozens of alignments, jumping to the desired one nearly instantly shaves time off everyday tasks.

Master It Open `BasicSite.dwg` from `www.sybex.com/go/masteringcivil3d2012`, and find parcel number 18 without using any AutoCAD commands or scrolling around on the drawing screen.

Modify the drawing scale and default object layers. Civil 3D understands that the end goal of most drawings is to create hard-copy construction documents. By setting a drawing scale and then setting many sizes in terms of plotted inches or millimeters, Civil 3D removes much of the mental gymnastics that other programs require when you're sizing text and symbols. By setting object layers at a drawing scale, Civil 3D makes uniformity of drawing files easier than ever to accomplish.

Master It Change `BasicSite.dwg` from the 100-scale drawing to a 40-scale drawing.

Modify the display of Civil 3D tooltips. The interactive display of object tooltips makes it easy to keep your focus on the drawing instead of an inquiry or report tools. When too many objects fill up a drawing, it can be information overload, so Civil 3D gives you granular control over the heads-up display tooltips.

Master It Within the same BasicSite drawing, turn off the tooltips for the Road A alignment.

Navigate the Ribbon's contextual tabs. As with AutoCAD, the Ribbon is the primary interface for accessing Civil 3D commands and features. When you select an AutoCAD Civil 3D object, the Ribbon displays commands and features related to that object. If several object types are selected, the Multiple contextual tab is displayed.

Master It Using the Ribbon interface, access the Alignment Style Editor for the Proposed Alignment style. (Hint: it's used by the Road A alignment.)

Create a curve tangent to the end of a line. It's rare that a property stands alone. Often, you must create adjacent properties, easements, or alignments from their legal descriptions.

Master It Create a curve tangent to the end of the first line drawn in the first exercise that meets the following specifications:

Radius: 200.00″

Arc Length: 66.580″

Label lines and curves. Although converting linework to parcels or alignments offers you the most robust labeling and analysis options, basic line- and curve-labeling tools are available when conversion isn't appropriate.

Master It Add line and curve labels to each entity created in the exercises. Choose a label that specifies the bearing and distance for your lines and length, radius, and delta of your curve.